

WHAT IS CLAIMED IS:

- 1 1. A method for coupling a head-end to end-users, comprising:
2 providing a mux-node;
3 connecting the head-end to the mux-node, the head-end exchanging analog
4 signals and digital base band signals with the mux-node;
5 connecting a plurality of mini-fiber-nodes (mFNs) to the mux-node; and
6 connecting the end-users to the mFNs using wired connections.
- 1 2. The method of claim 1, further comprising:
2 receiving a downstream communication signal from the head-end;
3 splitting the downstream communication signal into an analog
4 downstream signal and a digital downstream signal; and
5 transmitting the analog downstream signal to the mFNs.
- 1 3. The method of claim 2, further comprising:
2 splitting the analog downstream signal into a plurality of second analog
3 downstream signals where each of the second analog downstream signals is destined to
4 one or more of the mFNs; and
5 transmitting the second analog downstream signals to respective destined
6 ones of the mFNs.
- 1 4. The method of claim 2, further comprising demultiplexing the digital
2 downstream signal into one or more third downstream signals where each of the third
3 downstream signals is destined to a subset of the end-users served by one of the mFNs.
- 1 5. The method of claim 4, wherein the demultiplexing is based on one or
2 more of a time division multiplexing, frequency division multiplexing, wavelength
3 division multiplexing, and spatial division multiplexing.
- 1 6. The method of claim 1, further comprising:
2 receiving upstream communication signals from the mFNs;
3 separating the upstream communication signals into a first number of
4 analog signals;
5 combining the first number of the analog signals to generate a second
6 number of analog signals where the first number is greater than the second number; and
7 sending the second number of analog signals to the head-end.

1 7. The method of claim 6, wherein the combining includes one of frequency
2 stacking or adding the analog signals.

1 8. The method of claim 6, further comprising:
2 separating digital signals from the upstream communication signals; and
3 sending the digital signals to a mux/demux/router.

1 9. The method of claim 8, further comprising:
2 separating the digital signals into first signals destined for end-users
3 serviced by the mux-node and second signals not destined for the end-users serviced by
4 the mux-node;

5 extracting destinations of the first signals; and
6 transmitting the first signals to the mFNs corresponding to the
7 destinations.

1 10. The method of claim 1, further comprising:
2 receiving upstream digital communication signals from the mFNs;
3 multiplexing the signals; and
4 sending the multiplexed second signals to the head-end.

1 11. The method of claim 10, wherein the multiplexing is based on time
2 division multiplexing scheme.

1 12. A method for coupling a head-end to end-users, comprising:
2 providing a primary hub;
3 providing a secondary hub coupled to the primary hub;
4 connecting a mux-node to the secondary hub using a first number of one
5 or more first optical fibers; and
6 connecting a plurality of mini-fiber nodes (mFNs) to the mux-node using a
7 second number of second optical fibers, the second number being greater than the first
8 number.

1 13. The method of claim 12, further comprising:
2 converting in the mux-node first optical signals received from the mFNs to
3 electrical signals;
4 processing the electrical signals;

5 converting the processed electrical signals to second optical signals; and
6 transmitting the second optical signals to the secondary hub.

1 14. The method of claim 13, wherein a first wavelength tolerance of optical
2 signals transmitted over the first fibers is more stringent than a second tolerance of optical
3 wavelength of optical signals transmitted over the second optical fibers.

1 15. A method for coupling a head-end to end-users, comprising:
2 providing a head-end;
3 connecting a mux-node to the head-end using first optical fibers spanning
4 a first distance; and
5 connecting mini-fiber nodes (mFNs) to the mux-node using second optical
6 fibers spanning second distances, the first distance being greater than each of the second
7 distances.

1 16. The method of claim 15, wherein each of the second distances is less than
2 one kilometer.

1 17. The method for coupling end-users to a head-end, comprising:
2 converting in a mux-node first optical signals received from a first
3 lightwave interface to electrical signals;
4 processing the electrical signals;
5 converting the processed electrical signals to second optical signals; and
6 transmitting via a second lightwave interface the second optical signals to
7 the head-end.

1 18. The method of claim 17, wherein a first wavelength tolerance of the first
2 optical signals received from the first lightwave interface is less stringent than a second
3 tolerance of optical wavelength of the second optical signals transmitted via the second
4 lightwave interface to the head-end.

1 19. A communication system having a head-end and end-users, comprising:
2 a mux-node connected to the head-end, the head-end exchanging analog
3 signals and digital base band signals with the mux-node; and
4 a plurality of mini-fiber-nodes (mFNs) connected to the mux-node, the
5 end-users connected to the mFNs using wired connections.

1 20. The system of claim 19, wherein the mux-node receives a downstream
2 communication signal from the head-end, splits the downstream communication signal
3 into an analog downstream signal and a digital downstream signal and transmits the
4 analog downstream signal to the mFNs.

1 21. The system of claim 20, wherein the mux-node splits the analog
2 downstream signal into a plurality of second analog downstream signals where each of
3 the second analog downstream signals is destined to one or more of the mFNs, and
4 transmits the second analog downstream signals to respective destined ones of the mFNs.

1 22. The system of claim 20, wherein the mux-node demultiplexes the digital
2 downstream signal into one or more third downstream signals where each of the third
3 downstream signals is destined to a subset of the end-users served by one of the mFNs.

1 23. The system of claim 22, wherein the mux-node demultiplexes based on a
2 time division multiplexing, frequency division multiplexing, wavelength division
3 multiplexing, and spatial division multiplexing.

1 24. The system of claim 19, wherein the mux-node receives upstream
2 communication signals from the mFNs, separates the upstream communication signals
3 into a first number of analog signals, combines the first number of the analog signals to
4 generate a second number of analog signals where the first number is greater than the
5 second number and sends the second number of analog signals to the head-end.

1 25. The system of claim 24, wherein the mux-node combines based on one of
2 frequency stacking or adding the analog signals.

1 26. The system of claim 24, wherein the mux-node separates digital signals
2 from the upstream communication signals and sends the digital signals to a
3 mux/demux/router.

1 27. The system of claim 26, wherein the mux-node separates the digital
2 signals into first signals destined for end-users serviced by the mux-node and second
3 signals not destined for the end-users serviced by the mux-node, extracts destinations of
4 the first signals, and transmits the first signals to the mFNs corresponding to the
5 destinations.

1 28. The system of claim 19, wherein mux-node receives digital
2 communication signals from the mFNs, multiplexes the signals, and sends the
3 multiplexed signals to the head-end.

1 29. The system of claim 28, wherein the multiplexing is based on time
2 division multiplexing scheme.

1 30. A communication system that includes a head-end and end-users,
2 comprising:

3 a primary hub;

4 a secondary hub coupled to the primary hub; and

5 a mux-node connected to the secondary hub using a first number of one or
6 more first optical fibers; and

7 a plurality of mini-fiber nodes (mFNs) connected to the mux-node using a
8 second number of second optical fibers, the second number being greater than the first
9 number.

1 31. The system of claim 30, wherein the mux-node converts optical signals
2 received from the mFNs to electrical signals, processes the electrical signals, converts the
3 processed electrical signals to optical signals, and transmits the optical signals to the
4 secondary hub.

1 32. The system of claim 31, wherein a first wavelength tolerance of optical
2 signals transmitted over the first optical fibers is more stringent than a second tolerance of
3 optical wavelength of optical signals transmitted over the second optical fibers.

1 33. A communication system that includes a head-end and end-users,
2 comprising:

3 a head-end;

4 a mux-node connected to the head-end using first optical fibers spanning a
5 first distance; and

6 mini-fiber nodes (mFNs) connected to the mux-node using second optical
7 fibers spanning second distances, the first distance being greater than each of the second
8 distances.

1 34. The system of claim 33, wherein each of the second distances is less than
2 one kilometer.

1 35. A mux-node that couples end-users to a head-end, comprising:
2 a first lightwave interface; and
3 a second lightwave interface, the mux-node converts in a mux-node first
4 optical signals received from a first lightwave interface to electrical signals, processes the
5 electrical signals, converts the processed electrical signals to second optical signals, and
6 transmits via a second lightwave interface the second optical signals to the head-end.

1 36. The mux-node of claim 35, wherein a first wavelength tolerance of the
2 first optical signals received from the first lightwave interface is less stringent than a
3 second tolerance of optical wavelength of the second optical signals transmitted via the
4 second lightwave interface to the head-end.